REMARKS

This Reply is responsive to a non-final Office Action mailed February 24, 2006 and is accompanied by a petition for a three (3) month extension of time along with an authorization to charge the required statutory extension fee. All claims were rejected in the Office Action.

Specifically, the Examiner rejected claims 1-4, 6, 9, 17-20 and 25 under 35 U.S.C. §103(a) as being unpatentable over Iwase (US 6,656,618). Claims 5, 7, 8, 15, 16, 21, 23, 24, and 31 are rejected under 35 U.S.C. §103(a) as being unpatentable over Masuda et al. (US 2004/0036724) in view of Jones (US 4,533,986).

In this Reply, claims 1, 2, 4, 17, 18 and 20 have been amended and claims 15, 16, 28 and 31 have been cancelled. No new matter has been added.

Support for the limitation "processing circuitry having structure for receiving at least one of said plurality of output voltages as its supply voltage" now recited in claims 1 and 17 can be found in Figs 1, 2, 3, 8, as well as page 11, lines 15-18; page 14, lines 15-20, page 15, lines 10-11, and former claim 2. This important feature which provides the boosted supply voltage provided by the DC-DC converter to the processing circuit enables the claimed processing circuit to provide significant signal amplification, wherein the outputted time-varying signals have amplitudes beyond the supply voltage used by the DC-DC converter.

Claim 2 and 18 now recite the time-varying input signal comprises an RF, microwave or a digital signal. Support for RF, microwave or digital signals can be found, for example, on page 3, lines 19 and 20 of Applicant's specification. Claim 4 and 20 now recite "wherein said DC to DC converter includes structure for receiving opposite phase clock signals, said clock signals toggling between said supply voltage and ground". Support for this limitation which allows the output of the claimed DC to DC converter to operate dynamically and synchronously with other

circuit elements can be found, for example, on page 8, lines 14 and 15 of Applicant's specification. Support for the "processing circuit having a plurality of outputs coupled to said inputs of said plurality of integrated circuits" can be found throughout Applicant's specification, including Fig. 3 and corresponding specification portion. Support for the limitation "more than one of said plurality of output voltages [provided by the DC-DC converter are] coupled to said plurality of integrated circuits" now recited in claim 17 can be found in Fig. 3.

Before reviewing the cited art, Applicant will first review the claimed invention recited in amended claim 1. Amended claim 1 recites:

An integrated circuit, comprising:

at least one DC to DC converter including structure for receiving a supply voltage and structure for producing *a plurality of output voltages including* at least one *output* voltage at a greater voltage level than said supply voltage; and *processing circuitry having structure for receiving at least one of said plurality of output voltages as its supply voltage* and at least one time-varying input signal. The recited "processing circuitry having structure for receiving at least one of said plurality of output voltages as its supply voltage" which couples the boosted supply voltage provided by the DC-DC converter to the processing circuit enables the claimed processing circuit to provide significant signal amplification to the time varying signal being processed. In the preferred embodiment recited in claim 4, the DC to DC converter includes "structure for receiving opposite phase clock signals, said clock signals toggling between said supply voltage and ground". This preferred arrangement allows dynamic converter operation as well as synchronous operation with other on chip elements.

Claim 17 recites:

A circuit board, comprising:

a plurality of integrated circuits disposed on said board, said plurality of integrated circuits collectively requiring a plurality of different supply voltage levels and signals at respective inputs for operation; and

an integrated power supply circuit disposed on said board, said integrated power supply circuit comprising:

at least one DC to DC converter including structure for receiving a supply voltage and structure for producing *a plurality of output voltages including* at least *output* voltage at a greater voltage level than said supply voltage, more than one of *said plurality of output voltages coupled to said plurality of integrated circuits,* and ;

processing circuitry having structure for receiving at least one of said plurality of output voltages as its supply voltage and at least one time-varying input signal, said processing circuit modifying a parameter of said time-varying signal to produce a modified time-varying signal, said processing circuit having a plurality of outputs coupled to said inputs of said plurality of integrated circuits, wherein an output voltage level of a first of said outputs is greater than an output voltage level of a second of said outputs.

The circuit board recited in claim 17 includes the integrated circuit comprising at least one DC to DC converter and processing circuitry recited in claim 1, as well "a plurality of integrated circuits disposed on said board, said plurality of integrated circuits collectively *requiring a plurality of different supply voltage levels and signals at respective inputs for operation*. Thus, the integrated circuits are not the same integrated circuits and are thus not

duplicates of one another. Significantly, the recited integrated circuits require different supply voltages for operation.

As noted in Applicant's background:

Most modern board designs contain multiple integrated circuits (IC) from a wide variety of vendors. Depending on their technology and design, these ICs typically have several supply voltage requirements and produce several output voltages. As an example, a digital electronics board may require supply voltages of 5.0 volts, 3.3 volts, 2.0 volts and 1 volt.

Additionally, many external standards and connectors – such as General Purpose Interface Board (GPIB), Versa Module European (VME), Infrared Data Association (IrDA) and serial and parallel ports - to which ICs may be interfaced may require substantial voltages to maintain sufficient noise margins. Peripheral devices including liquid crystal displays (LCD), keyboards, modems and disk drives are also often coupled to digital boards and generally require additional interface voltages. In view of the variety of supply voltages required by the various ICs on digital and analog boards, design engineers face significant obstacles when implementing multiple ICs on such boards.

In response, designers often attempt to select components with identical supply voltages; however, such an approach is generally impractical in view of the numerous components and manufacturers involved in the design of the boards. *As a result, most boards contain multiple voltage supplies with independent voltage regulators and passive filter elements or extra ICs that act as voltage translating buffers to convert one supply voltage to a plurality of different supply voltages.* Neither of these solutions, however, is particularly effective, as each of them is costly, increases design complexity and consumes large areas of board space.

The claimed invention recited in claim 1 (DC-DC converter with signal processor) placed on a circuit board together with a plurality of different ICs recited in claim 17 solves the problem described above that before the invention generally necessitated circuit boards to contain multiple voltage supplies with independent voltage regulators and passive filter elements or extra ICs that act as voltage translating buffers to convert one supply voltage to a plurality of different supply voltages. Applicants note that the plurality of ICs on the claimed board are not mere duplicates of one another. *To the contrary, in the case the ICs are mere duplicates of one another, a single power supply can be used, thus mooting the need for the present claimed invention.*

Turning now to the cited art,

According to the Examiner regarding Iwase:

Iwase teaches a circuit comprising a DC-DC converter (38) for receiving a supply voltage and produces an intermediate voltage that is greater than the supply voltage and received by the processing circuitry (inverter, 44) (Col. 7, lines 44-46). The processing circuitry receives a time-varying input signal (intermediate voltage) and modifies the voltage level to produce three modified time-varying signals (Col. 8, lines 15-22). The signal and processing circuitry are analog. He fails to teach this circuit being an IC circuit and having a plurality of them disposed on a circuit board. It would have been obvious to one of ordinary skill in the art at the time of the invention to have this circuit be an IC circuit, since it has been held that forming in one piece an article which has formerly been formed in two pieces and put together involves only routine skill in the art. *Howard v. Detroit Stove Works*, 150 U.S.164 (1893). It also would have been obvious to one of ordinary skill in the art at the time of the invention to place a plurality of these IC circuits on a circuit board, since it has been held that mere duplication of the essential working parts of a device has no patentable significance unless a new and unexpected result is produced. *In re Harza*, 124 USPQ 378.

Iwase discloses a system which enables fuel cells to be activated at a working point of high energy conversion efficiency. A control unit calculates a required output of an inverter from an input accelerator travel. The control unit specifies an output electric current-output voltage characteristic corresponding to a gas flow rate, obtains a point of highest energy conversion efficiency on the specified characteristic to specify the point as a working point of fuel cells, and computes an output electric power of the fuel cells at the specified working point. The control unit determines an output voltage required to a battery, based on a difference between the calculated required output of the inverter and the computed output electric power of the fuel cells

and a state of charge of the battery. The control unit controls a DC--DC converter and regulates the output voltage of the DC--DC converter, so as to cause the battery to generate the output voltage thus determined. The control unit subsequently controls the inverter, so as to cause a motor to consume electric power corresponding to the required output.

The DC-DC converter (38) disclosed by Iwase does provide an output which is a boosted voltage. The boosted voltage is provided as an input to Inverter 44 (referred to by the Examiner as the "processing circuit") which converts the d.c boosted voltage supplied by DC-DC converter 38 into three-phase a.c. voltages and applies the a.c. voltages to motor 46.

The input to Iwase's "processing circuit 44" is thus a d.c. input, not a time varying input signal. Moreover, Iwase does not disclose or suggest "processing circuit 44" having structure for receiving the boosted voltage from converter 38 as its supply voltage nor a structure for modifying a parameter of a time-varying signal to produce a modified time-varying signal because processing circuit since it is only designed to receive d.c. inputs.

In contrast, Applicant's amended claim 1 recites an integrated circuit comprising at least one DC to DC converter producing a plurality of output voltages including at least one output voltage at a greater voltage level than said supply voltage; and *processing circuitry having structure for receiving at least one of said plurality of output voltages as its supply voltage* and at least one time-varying input signal. Applicant's recited "processing circuitry having structure for receiving *at least one of said plurality of output voltages as its supply voltage*" which couples the boosted supply voltage provided by the DC-DC converter to the processing circuit enables the claimed processing circuit to provide significant signal amplification to the time varying signal being processed. As noted above, Iwase does not disclose or suggest the processing circuit receiving the boosted voltage as its supply voltage, nor receiving a time varying input since

"processing circuit' 44 only receives d.c. inputs. As a result, Iwase's "processing circuit 44" clearly cannot" modify a parameter of said time-varying signal to produce a modified time-varying signal" recited by Applicant since Iwase's processing circuit 44 only receives d.c. signals. In view of the non-obvious distinctions described above, Applicant submits amended claim 1 and its respective dependent claims are patentable over Iwase.

Certain dependent claims add inventive step evidencing limitations. Claim 2 recites the "time-varying input signal comprises an RF, microwave or a digital signal". Iwase's signals feed to "processing circuit 44" are d.c. signals. In addition, claim 4 recites said DC to DC converter includes structure for receiving opposite phase clock signals, said clock signals toggling between said supply voltage and ground". This preferred arrangement allows Applicant's claimed invention to provide dynamic converter operation as well as synchronous operation with other on chip (or off chip) elements.

Amended claim 17 recites a circuit board which includes the integrated circuit recited in claim 1 along with other integrated circuits on the board, and adds several additional non-obvious limitations. Specifically, "a plurality of integrated circuits [are] disposed on said board, said plurality of integrated circuits collectively *requiring a plurality of different supply voltage levels and signals at respective inputs for operation*. "More than one of said plurality of output voltages [provided by the DC-DC converter are] coupled to said plurality of integrated circuits". Thus, the integrated circuits are not the same integrated circuits and are thus not duplicates of one another. Significantly, the recited integrated circuits require different supply voltages for operation. The recited DC-DC converter supplies a plurality of the integrated circuits on the common board with their various supply voltages.

The Examiner admits that Iwase and the other cited art fail to teach the claimed circuit board having a plurality of ICs. However, the Examiner asserts that:

> (1893). It also would have been obvious to one of ordinary skill in the art at the time of the invention to place a plurality of these IC circuits on a circuit board, since it has been held that mere duplication of the essential working parts of a device has no patentable significance unless a new and unexpected result is produced. *In re Harza*, 124 USPQ 378.

Applicant respectfully disagrees with the above-described obviousness rejection because the premise (duplicate ICs) upon which the conclusion (obviousness) is based is false. Specifically, the claimed invention specifically recites the ICs are different by reciting "said plurality of integrated circuits collectively requiring a plurality of different supply voltage levels". As noted above, the need for various supply voltages to supply a variety of circuits on a given board prompted the Inventor to conceive of and develop the present invention.

As mentioned above, the claimed invention recited in claim 17 solves the problem described above that before the invention generally necessitated boards to contain multiple voltage supplies with independent voltage regulators and passive filter elements or extra ICs that act as voltage translating buffers to convert one supply voltage to a plurality of different supply voltages. With Applicant's invention, the various integrated circuits having a variety of supply voltage needs are supplied their required supplied voltage by the claimed DC-DC converter. Since the plurality of ICs on the claimed board are not mere duplicates of one another, claim 17 is patentable over Iwase based on inclusion of the limitations recited in claim 1 together with the non-obvious arrangement of placing a "plurality of integrated circuits collectively requiring a plurality of different supply voltage levels" on the same circuit board and with the DC-DC converter providing the ICs with their different supply voltages.

Claims 5, 7, 8, 15, 16, 21, 23, 24, and 31 are rejected under 35 U.S.C. §103(a) as being unpatentable over Masuda et al. (US 2004/0036724) and Jones (US 4,533,986). According to the Examiner:

Masuda teaches a DC-DC converter that receives a supply voltage (30V) and produces a plurality of different intermediate voltages to supply to inkjet printheads. He also teaches processing circuitry (D/A converter, 64) for receiving one time-varying digital signal and modifying a parameter of the signal to produce a modified signal ([0106]). Masuda fails to teach the intermediate voltage being greater than the supply voltage. Jones teaches the use of a DC-DC boost converter (Abstract). It would have been obvious to one of ordinary skill in the art at the time of the invention to replace the DC-DC converter in Masuda's invention with a DC-DC boost converter in case the supply voltage decreased or so that the invention could be powered by a lower voltage source. He also fails to teach this circuit being an IC circuit and having a plurality of them disposed on a circuit board. It would have been obvious to one of ordinary skill in the art at the time of the invention to have this circuit be an IC circuit, since it has been held that forming in one piece an article which has formerly been formed in two pieces and put together involves only routine skill in the art. *Howard v. Detroit Stove Works*, 150 U.S.164 (1893). It also would have been obvious to one of ordinary skill in the art at the time of the invention to place a plurality of these IC circuits on a circuit board, since it has been held that mere duplication of the essential working parts of a device has no patentable significance unless a new and unexpected result is produced. *In re Harza*, 124 USPQ 378.

Masuda is entitled "Printing apparatus" and discloses a printing apparatus which performs printing by scanning a carriage unit over a print medium based on information transmitted from an external apparatus. The body (53) of the carriage unit includes: a removable printhead (51) having a plurality of nozzles for discharging ink; a heat source detection unit (59)

for detecting the number of heat sources driving the nozzles; and a voltage generation unit (60) for supplying a voltage to the heat sources for driving the nozzles in accordance with the number of heat sources detected by the heat source detection unit.

Masuda has little relevance to the claimed invention, and in fact teaches away from the claimed invention recited in claim 17. Referring to Fig. 6 which shows the construction of the head carriage circuit board 52 shown in Fig. 5, the printing serial signal is series-to-parallel converted (converter 61), parallel-to–series converted (converter 62), counted (counter 63) and then coupled to a D/A converter (64) which is referred to by the Examiner as Masuda's "processing circuit". Converted (64) receives a digital bit stream and outputs a d.c. signal which is d.c. to d.c. converted by DC/DC converter 60 which includes output voltage control unit 65.

Converters 61 and 62, counter 63 and D/A converter 64 and DC/Dc converter 60 are all ICs disposed on board 52. The is no hint that the output of DC/DC converter 60 is supplied to any of the circuits on board 52. Instead, the output of DC/DC converter 60 is supplied the print nozzles (remote from board 52) controlled to change the output voltage in accordance with the number of simultaneously driven nozzles as noted below.

According to col. 7, paragraph 106, last 3 sentences:

> The digital signal is converted to an analog signal by the D/A converter 64. The analog signal is inputted to the output voltage control unit 65 of the DC/DC converter 60 in synchronization with the driving pulse for each block. The DC/DC converter 60 is controlled to change the output voltage in accordance with the number of simultaneously driven nozzles.

In contrast, Applicant's amended claim 1 recites an integrated circuit, comprising:

An integrated circuit, comprising:

at least one DC to DC converter including structure for receiving a supply voltage and structure for producing *a plurality of output voltages including* at least one *output* voltages at a greater voltage level than said supply voltage; and

processing circuitry having structure for receiving at least one of said plurality of output voltages as its supply voltage and at least one time-varying input signal, said processing circuit modifying a parameter of said time-varying signal to produce a modified time-varying signal, said processing circuit having a plurality of outputs, wherein an output voltage level of a first of said outputs is greater than an output voltage level of a second of said outputs.

Applicant's recited "processing circuitry having structure for receiving at least one of said plurality of output voltages as its supply voltage" which couples the boosted supply voltage provided by the DC-DC converter to the processing circuit enables the claimed processing circuit to provide significant signal amplification to the time varying signal being processed. As noted above, like Iwase, Masuda does not disclose or suggest the processing circuit receiving the boosted voltage as its supply voltage. In view of this non-obvious distinctions, Applicant submits amended claim 1 and its respective dependent claims are patentable over Masuda.

Certain dependent claims add inventive step evidencing limitations. Claim 4 recites said DC to DC converter includes structure for receiving opposite phase clock signals, said clock signals toggling between said supply voltage and ground". This preferred arrangement allows Applicant's claimed invention to provide dynamic converter operation as well as synchronous operation with other on chip (or off chip) elements.

Amended claim 17 recites a circuit board which includes the integrated circuit recited in claim 1 along with other integrated circuits on the board and adds several additional non-obvious limitations. Specifically, "a plurality of integrated circuits [are] disposed on said board, said plurality of integrated circuits collectively *requiring a plurality of different supply voltage levels and signals at respective inputs for operation*. Thus, the integrated circuits are not the same integrated circuits and are thus not duplicates of one another. Significantly, the recited integrated

circuits require different supply voltages for operation. More than one of the plurality of output voltages [provided by the DC-DC converter are] coupled to the plurality of integrated circuits thus providing their varying supply voltage needs.

The Examiner admits that Masuda and the other cited art fail to teach the claimed circuit board having a plurality of ICs. However, the Examiner asserts that:

> **(1893). It also would have been obvious to one of ordinary skill in the art at the time of the invention to place a plurality of these IC circuits on a circuit board, since it has been held that mere duplication of the essential working parts of a device has no patentable significance unless a new and unexpected result is produced. *In re Harza*, 124 USPQ 378.**

As with Iwase, Applicant respectfully disagrees with the above-described obviousness rejection because the premise (duplicate ICs) upon which the conclusion (obviousness) is based is false. Specifically, the claimed invention specifically recites the ICs are different by reciting "said plurality of integrated circuits collectively requiring a plurality of different supply voltage levels". As noted above, the need for various supply voltages to supply a variety of circuits on a given board prompted the Inventor to conceive of and develop the present invention which solves the problem presented.

As mentioned above, Masuda teaches away from the claimed invention recited in claim 17. Specifically, ICs 61, 62, 63, 64 and 65 on the head carriage circuit board 52 almost certainly each require different supply voltages. Since Masuda does not mention how to supply a plurality of different supply voltages, without the benefit of Applicant's claimed invention recited in claim 17, Masuda is forced to solve the ICs having varying supply voltage problem the conventional way using multiple voltage supplies with independent voltage regulators and passive filter elements or extra ICs that act as voltage translating buffers to convert one supply voltage to a plurality of different supply voltages and thus teachers away from the claimed invention.

Moreover, since Applicant's claimed plurality of ICs on the claimed board (as with Masuda's board) are not mere duplicates of one another, claim 17 is patentable over Masuda based Applicants' inclusion of the non-obvious limitations recited in claim 1 together with the non-obvious arrangement of placing a "plurality of integrated circuits collectively requiring a plurality of different supply voltage levels" on the same circuit board and coupling "*said plurality of output voltages" generated by the claimed DC to DC converter [coupled] to said plurality of integrated circuits*".. In view of this non-obvious distinctions, Applicant submits amended claim 17 and its respective dependent claims are patentable over Masuda.

Applicant has made every effort to present claims which distinguish over the cited art, and it is believed that all claims are now in condition for allowance. However, Applicants request that the Examiner call the undersigned (direct line 561-671-3662) if anything further is required by the Examiner prior to issuance of a Notice of Allowance for all claims.

The Commissioner for Patents is authorized to charge any deficiency in fees due, or credit an excess in fees with the filing of the papers submitted herein during prosecution of this application to Deposit Account No. 50-0951.

Respectfully submitted,

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